

Tulsa Tornado Tribune

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Where People Who Know the Weather Get Their Weather

National Weather Service Tulsa, Oklahoma

Fall 2015

Wednesday, December 16, 2015

A RECORD-SHATTERING MONTH

Historic rainfall in May ended drought conditions...but proved to be too much of a good thing.



OK State Highway 3 west of Rattan at Rattan Landing was under water May 25, 2015, in Pushmataha County.

From: ODOT

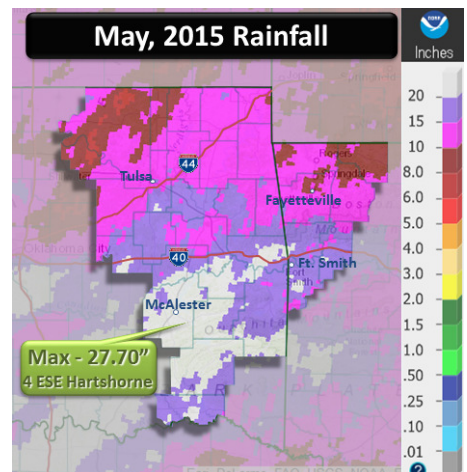
Climatologically, May is the wettest month on average across eastern Oklahoma and western Arkansas, so we have come to expect a lot of moisture at that time of year. This year, however, things got completely out of hand with repeated bouts of heavy rainfall through the month. The good news from all of this is that we got some relief, albeit temporary, from the long-term drought conditions that have plagued our region for the past 4 to 5 years.

Unfortunately, the rain just wouldn't stop, and widespread, devastating flooding occurred across eastern Oklahoma and western Arkansas as a result. Many locations along and south of Interstate 40 received nearly half a year's worth of rainfall during a 3 week period. The rain led to considerable flash flooding and mainstem river flooding during the month. The floods resulted in seven fatalities and displaced a large number of residents.

RECORD RAINFALL

For the entire state of Oklahoma, the average rainfall for May 2015 was 14.06", setting the new record for not only the wettest May, but also for the wettest month on rec-

ord! The previous record was 10.75" in October 1941. The state of Arkansas recorded its second wettest May on record with 10.35". Fort Smith also set records for both the wettest May and wettest month ever, with a total of 19.85". The previous May record was 13.67" in 1943, and the previous wettest month record was 15.02" in June 1945. Also, Tulsa saw its 2nd wettest May with 14.77" (Record is 18.00" in 1943), while Fayetteville saw its 3rd wettest May with 13.01" (Record is 13.39" in 1957).



Radar-derived estimated observed precipitation (using both radar and gauge data) shows most of the area saw between 10 and 25 inches of rain in May 2015. Normal May rain is between 5 and 6 inches.

Record-Shattering Continues on page 2



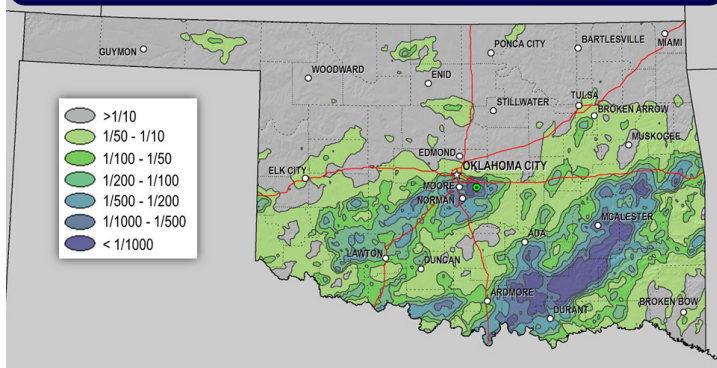
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RECORD-SHATTERING

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Oklahoma Annual Exceedance Probabilities for 30-Day Rainfall May 2-31, 2015



An analysis by the NWS Hydrometeorological Design Studies Center determined that several areas along and south of I-40 in southeast Oklahoma had precipitation totals with less than a 0.1% annual chance (1,000-year event) of occurring. The highest rainfall total in the NWS Tulsa forecast area was a whopping 27.70" 4 miles ESE of Hartshorne, OK (Pittsburg County). The average 0.1% annual occurrence (1,000-year event) for 30 days at nearby McAlester Regional Airport is 26.10".

RIVER FLOODING

As rain fell on increasingly saturated soils, runoff led to a series of mainstem river floods. In May alone, there were 36 river floods and 46 crests for 18 river forecast points (out of 33 in the HSA). Of those, 8 were major and 27 were moderate. Nine floods continued into June, with one additional major flooding crest in June. The NWS Tulsa office issued 1,045 total flood products during the event, including both river and flash flood watches, warnings, advisories, and follow up statements.

The Poteau River flooded three times in May. The first resulted in moderate flooding near Poteau, but major flooding and one fatality near Panama. The third flood, which lasted 9 days near Poteau and 11 days near Panama, caused major flooding along the river downstream of Wister Lake. The Arkansas River at Van Buren exceeded flood stage four times in May. The river crested twice above major flood stage during an 11-day flood at the end of the month. Likewise, the Arkansas River at Ozark

Lock and Dam exceeded flood stage three times in May, twice cresting above major flood stage during the last flood. The Red River at Arthur City, TX, flooded twice in May, cresting above major flood stage during the second flood, which lasted 17 days. The Kiamichi River near Antlers had three floods, the second including 4 crests above moderate flood stage. The Neosho River near Commerce flooded twice, with three crests above moderate flood stage during the second flood.

RESERVOIR LEVELS

According to the US Army Corps of Engineers, all major reservoirs in the area were operating well into their flood pools as of May 31, except for Skiatook Lake, which was at 81% of its conservation pool. But, it should be noted that Skiatook Lake was only at 53% at the end of April. Sardis Lake, Wister Lake, Hugo Lake and Eufaula Lake all were still at or above 100% of flood pool capacity by the end of May.



Lake Eufaula Dam spillway pictured on May 15, 2015.
Inset: Flooding downstream from Eufaula Dam.

Photo Courtesy of US Army Corps of Engineers

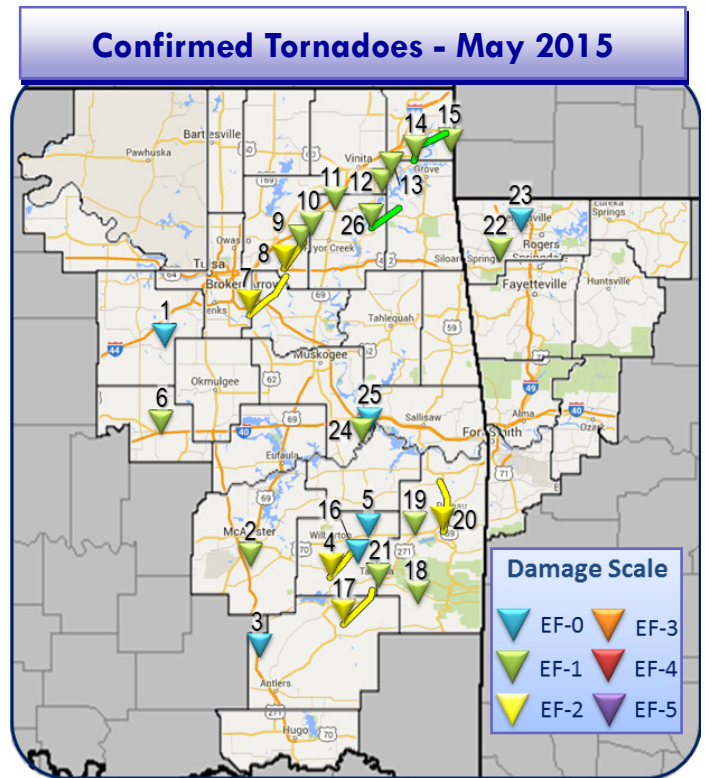
Two lakes set new pool records this month: Wister Lake 508.35' (previous record 508.22') and Hugo Lake 440.11' (previous record 440.05'). By May 12, Eufaula Lake exceeded the top of its flood control pool and went into surcharge, remaining there until May 31. The highest lake elevation was 599.68' (128% of flood pool) during the afternoon of the 26th. For reference, the record pool elevation for Eufaula Lake is 599.77' and the top of the surcharge pool is 600.00'. Eufaula Dam was completed in 1964 and impounds one of the world's largest man-made lakes (covering 102,500 acres). ⚡

MAY 2015 TORNADOES

While flooding gathered most of the weather headlines during May, it was also quite an active month in terms of severe weather. A total of 26 tornadoes were confirmed in the NWS Tulsa warning area, 5 of them strong. This is significantly above the May average of 7 (1950-present), and more than the annual average of 18.

This rates as the 5th most May tornadoes recorded in the NWS Tulsa area, and we currently rank 8th annually through October 31. However, it should be noted that tornado reporting has increased dramatically in the past couple of decades, so a true historical context is difficult to ascertain.

The stronger tornado events are summarized elsewhere in this newsletter. Fortunately, despite the high number of tornadoes, there were no deaths or serious injuries reported. ⚡



	Date	Time (CDT)	Counties	Start/End Location	Length (miles)	Width (yards)	Max Wind (mph)	Remarks
1	5/6	258AM	Creek	5.5 SSW - 4.5 S Kellyville	1.5	100	75-85	Snapped large limbs, split trees.
2	5/10	901AM	Pittsburg	1 SE MLC Airport - 3 SE McAlester	3.8	240	90-100	Barn destroyed; large limbs snapped; grain silo rolled.
3	5/10	618PM	Pushmataha	7.5 NW - 8 NNW Moyers	1.7	100	Unk	Chasers witnessed; inaccessible by road.
4	5/10	718PM	Latimer	2.9 S Vet Colony - 3.7 SW Red Oak	15	880	115-125	Damaged homes, metal building; trees uprooted/snapped.
5	5/10	746PM	Latimer	1.6 NW - 4.1 NE Red Oak	3.7	75	65-75	Snapped large limbs.
6	5/16	1020PM	Okfuskee	3.7 NE - 5.1 NE Okemah	1.4	110	90-100	Uprooted trees.
7	5/16	1126PM	Wagoner, Rogers	4.4 SW Oneta - 3.4 WSW Inola	16	1000	110-120	See section on this tornado.
8	5/16	1143PM	Rogers	3.7 WNW Inola - 5.7 ENE Tiawah	9.8	1500	110-120	See section on this tornado.
9	5/16	1152PM	Rogers	5.4 NE - 8.4 NE Tiawah	3.3	300	90-100	Damaged several homes, uprooted trees.
10	5/17	1200AM	Mayes	5.9 NW - 6.2 NW Pryor	2.3	450	95-105	Snapped/uprooted trees.
11	5/17	1210AM	Mayes	2.5 NNW - 5.8 NE Adair	4.5	600	95-105	Damaged 2 homes, destroyed barns/outbuildings.
12	5/17	1224AM	Craig, Delaware	2.4 NNE Ketchum - 2 NNE Cleora	4.6	550	95-105	Destroyed mobile home, barns, outbuildings.
13	5/17	1230AM	Delaware, Ottawa	2.1 WNW Bernice - 4.9 E Afton	6.7	1100	95-105	Damaged 2 mobile homes; snapped/uprooted trees.
14	5/17	1238AM	Ottawa	4.9 SSE Fairland - 2.3 ESE Wyandotte	11.5	650	95-105	1 injured - Destroyed metal building, shop; damaged barns.
15	5/17	1251AM	Ottawa	5 ESE - 6 E Wyandotte	1.4	200	90-100	Snapped limbs, uprooted trees. Contd into Newton Co, MO.
16	5/23	844PM	Latimer	7.2 SW - 6.4 WSW Red Oak	1.6	75	75-85	Snapped tree limbs.
17	5/25	452PM	Pushmataha, Latimer	8 ESE Clayton - 13.6 E Yanush	13.3	1000	115-125	Snapped/uprooted numerous trees; destroyed outbuilding.
18	5/25	517PM	Le Flore	3.4 SE - 5.6 ENE Whitesboro	6.4	600	95-105	Snapped/uprooted numerous trees.
19	5/25	534PM	Le Flore	2.7 NE - 9.3 NNE Fanshawe	7.5	250	95-105	Snapped/uprooted trees.
20	5/25	548PM	Le Flore	3.6 ENE Wister - 2.6 NW Panama	15.5	1700	110-120	See section on this tornado.
21	5/28	958AM	Le Flore	1.4 NNE - 1.7 NE Talihiina	0.5	75	100-110	Blew roof off house; damaged trees.
22	5/28	209PM	Benton	0.3 SSW - 1.3 NNE Highfill	1.6	100	90-100	Damaged barns; uprooted trees.
23	5/28	240PM	Benton	2.5 NW Bentonville	0.2	50	70-80	Spotter reported; Damaged barns, trees.
24	5/29	151PM	Muskogee	8.7 S - 4.5 SE Webbers Falls	5	400	90-100	Damaged homes/outbuildings; snapped/uprooted trees.
25	5/29	216PM	Sequoyah	3.3 SE - 2.5 SE Gore	1.5	100	75-85	Snapped limbs; damaged small buildings.
26	5/29	227PM	Mayes, Delaware	2.3 SW Spavinaw - 5 NW Eucha	9.5	1500	100-110	Damaged roofs; uprooted/snapped trees.

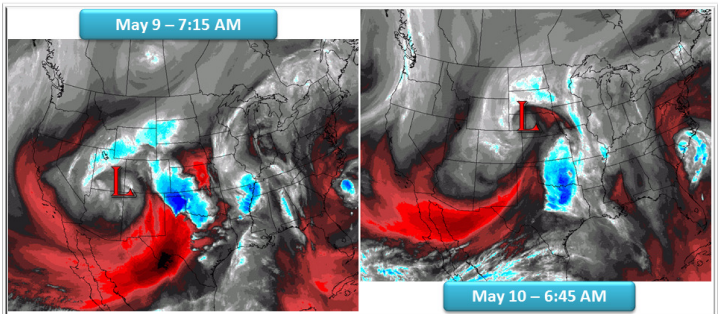
MAY 6-11: THE FIRST ROUND

Several rounds of thunderstorms affected eastern Oklahoma and western Arkansas from May 8-10, as a potent upper level storm system slowly moved across the plains.

The pleasant start to May didn't last too long as an unsettled weather pattern brought several days of rain to eastern Oklahoma and northwest Arkansas starting on the 5th. Strong thunderstorms during the evening and overnight hours spawned a brief EFO tornado near Kellyville, OK (Creek Co.) and brought rainfall totals of 2 to 3 inches west of Highway 75 and across Wagoner County.

A strong mid-level low over the northwest U.S. dove south on the 7th and 8th, then moved into the Plains on the 9th-10th, resulting in several rounds of rain over the region. Each of these rounds of storms brought copious amounts of rain, resulting in widespread flash flooding and river flooding. A complex of thunderstorms developed in western Oklahoma during the afternoon of the 7th, and then moved into eastern Oklahoma and western Arkansas during the evening, continuing into the early morning of the 8th. Western Choctaw, the southeastern half of Pushmataha, and southern Le Flore Counties saw between 2 and 5 inches of rain.

The frontal boundary associated with this system remained across southwest Oklahoma, where yet another round of storms developed and spread east during the evening of the 8th through the morning of the 9th. Most areas received from 1 to 2 inches of rain, with some seeing up to 5 inches. The hardest hit areas were in Okfuskee, Tulsa, and Wagoner Counties, where flash flooding was reported. Okemah, OK (Okfuskee Co.) measured 2.91" of rain in only 1 hour, with some homes and several roads flooded. Sections of I-44 were closed during the evening of the 8th as water covered the roadway, stalling vehicles.



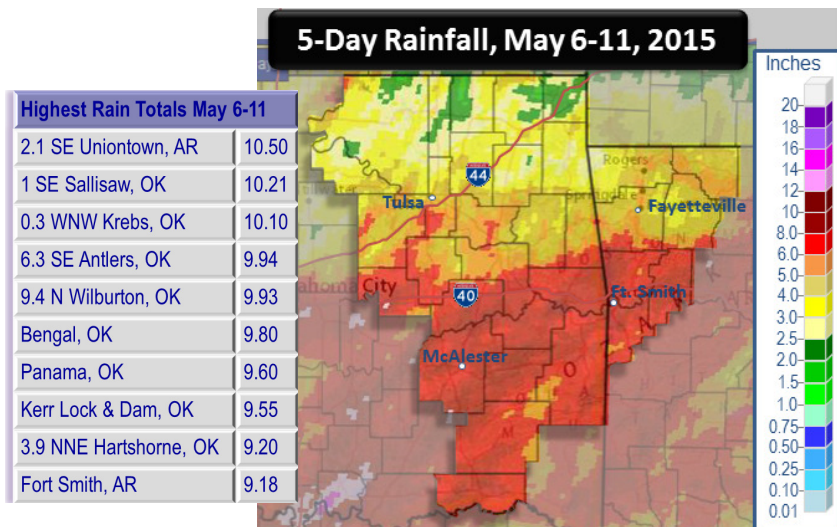
Water Vapor Imagery shows the progression of the upper level low from May 9 to May 10.

Even more storms developed during the afternoon and evening of the 9th across western and central Oklahoma, eventually moving through the area that night. Widespread 2 to 6 inch rainfall amounts created widespread flash flooding during the evening and overnight hours.

Several bridges were washed out in Boley, OK (Okfuskee Co.), swift water rescues were reported in Ozark, AR (Franklin Co.), Vernon, and Sallisaw, OK (Sequoyah Co.). There were numerous road closures or washouts throughout the impacted area. As much as two feet of water was over some roads that rarely flood in Onapa, OK (McIntosh Co.).

The final round of showers and thunderstorms affected eastern Oklahoma and northwest Arkansas on the 10th as the cold front moved across the region. By early in the

Early May Continues on page 5



EARLY MAY

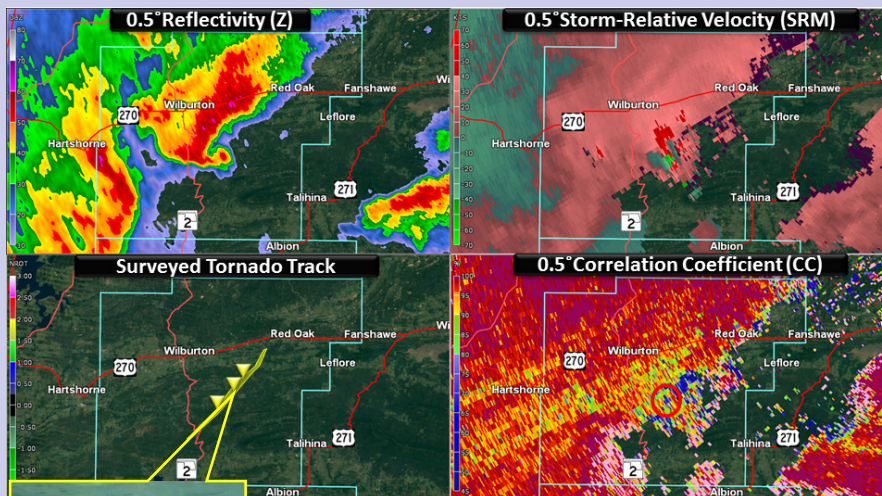
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morning of the 11th, widespread 1.5 to 4 inch totals were common once again, with highest amounts generally southeast of a McAlester, OK to Fayetteville, AR line. This was the second day in a row that east central Oklahoma and west central Arkansas were hit by very heavy rain. Numerous roads were once again impacted by flash flooding. Some embedded supercell storms resulted in severe weather in the evening, including four tornadoes: an EF-0 near Moyers; an EF-2 and an EF-0 both near Red Oak; and an EF1 near the McAlester airport.

The recurring rounds of heavy rain brought one week rainfall totals ranging from 3 to over 11 inches of rain! Much of the area near and south of I-40 saw 7 to 10 inches of rain, approximately twice the normal rainfall

for this area for the entire month of May. The rains caused moderate to major flooding of several mainstem rivers. In all, there were 1 Major, 6 Moderate, and 2 Minor floods on area rivers. The Poteau River near Panama crested at 43.54 feet on the 12th, the 6th highest on record. One flood related fatality occurred near Spiro, OK (LeFlore Co.), where a 60-year-old man drowned in the Poteau River while attempting to rescue cattle around 3:30am CDT on May 11 (his body was not recovered until May 13). Another fatality occurred on the 12th in Rudy, AR, when a 19-year-old male drowned while trying to swim in the falling, but still swollen and fast flowing Frog Bayou (Grotto Hole). Initial estimates on damages to roads and bridges are in the \$500,000 range for Le Flore County. By the early morning hours of the 12th, Eufaula Lake exceeded the top of its flood control pool and went into surcharge, where it remained until May 31. ⚡

Latimer County, OK Tornado 5/10/15



Above: Dual-pol Doppler data from the Ft. Smith Radar at 727 PM CDT on May 10 shows a possible Tornadic Debris Signature (TDS) in central Latimer County in an area where significant damage was found. A small enhanced area of reflectivity corresponds closely to an area of strong rotation, along with a subtle weakness in CC (red circle).

Left: A significant portion of the tornado path was over open country, areas not accessible by road, or areas gated or beyond flooded roads. Aerial photos and information provided by FOX 23 Tulsa meteorologists James Aydelott and Ben Walnick following a flight over the path were very useful in filling in the gaps of the ground survey.

The first strong tornado to strike the area in May 2015 developed in southern Latimer County, southwest of the intersection of State Highways 1 and 2, in open country. The tornado moved northeast over a swath of heavily wooded country, where a number of large trees were uprooted and snapped. In addition, an oil drilling platform was damaged and a home was destroyed.

More homes were damaged as the tornado crossed Southeast Hulsey Prairie Road. Numerous trees were snapped and uprooted as the twister continued toward Southeast 120th Road, where a metal building was severely damaged. The tornado also damaged the Cravens Volunteer Fire Department, snapped and uprooted trees, and damaged outbuildings before dissipating prior to reaching Northeast 120th Road. Based on the damage to a home, a metal building, and large swaths of trees that were virtually cleared by the tornado, the twister was rated an EF-2.

MAY 16-21: MORE SEVERE STORMS AND FLOODS

Series of late evening and early morning twisters strike northeast Oklahoma on May 16, with more flooding to follow.

Following a few days of relative quiet (by May 2015 standards), another powerful upper level low moved into the western U.S. by the 15th. During this time, on the large scale, a persistent split-flow block continued in the west, with ridging centered from Florida to the Great Lakes. This pattern, common throughout the month, left the Central and Southern Plains directly in the primary storm track.

As the system moved east on the 16th, thunderstorms, some of which were supercells, developed along a Pacific cold front and dry line in western Oklahoma as the main upper trough swung into the Central Plains. These storms eventually merged into a large quasi-linear convective system (QLCS) as they moved east into the area during the evening.

A few discrete supercells formed ahead of the QLCS early that evening, however, and merged with the line over Tulsa County. This led to the development of a large bow echo, with several tornadoes developing near the comma-head as it moved northeast into Missouri. This would turn out to be the most significant tornado event of the year, at least in terms of number of tornadoes. Nine were confirmed, including strong twisters (both EF-2) in Broken Arrow, OK, and near Inola, OK.

In addition to the severe weather on the 16th, flash flooding resulted from the heavy rainfall and wet antecedent conditions. The entire forecast area received around 0.50" to around 2" of rain, with pockets of up to 3". Flash flooding occurred along the corridor of heaviest rain from Pittsburg County, OK, to southern Washington County, AR. Several state and U.S. highways were closed due to high water.

The rain moved east of the area by sunrise on the 17th,

but by this point in the month, it was becoming clear we just weren't going to get a break. Soils across most of the area were beyond saturated, especially in areas along and south of I-40, and the upper level pattern was locked on to the western trough, eastern ridge regime that kept our region in an active storm track.

Another cold front sagged south across the area on the 18th, bringing locally heavy rain to northeast Oklahoma and northwest Arkansas. The front began to lift northward on the 19th, stalling near I-40 during the evening. Widespread thunderstorms developed as an upper level trough ejected into the Plains, with heaviest rainfall focused near the warm front along and south of I-40 as a complex of storms moved across southeast Oklahoma and west central Arkansas. These storms were once again very efficient at making rain, with widespread 1.5 to 4 inch amounts of rain. Portions of Haskell, Le Flore, Latimer, Pushmataha, and Pittsburg Counties saw 4" to 7" of rain.



Excessive rainfall in May caused many reservoirs, such as Lake Eufaula pictured above, to rise well into their flood pools.

Photo Courtesy of USACE Tulsa

The heavy rain on top of saturated soils led to widespread, extensive flash flooding along and south of I-40. This was the same area that received very heavy rain 1-2 weeks prior. Flood waters inundated numerous buildings in Tahleah, OK (Le Flore Co.), including the housing authority, the Choctaw Nation Hospital, the high school, and a nursing home. Numerous roads were under water across the area as well.

More river flooding resulted with excessive runoff. The

May 16-21 Continues on page 7

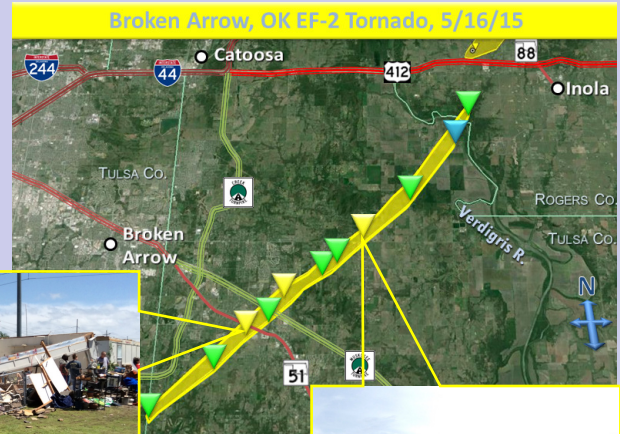
Broken Arrow, Inola, OK Tornadoes 5/16/15

The first of two strong tornadoes on May 16 developed around 11:30 pm, just east of the Wagoner/Tulsa county line a few miles south of the Creek Turnpike. It moved rapidly northeast damaging as many as 120 homes, some severely, destroying barns and outbuildings, and damaging a significant number of trees and power poles. The survey team followed the path to near the Verdigris River in northeast Wagoner County, where a barn was severely damaged and several trees were snapped or uprooted. KOTV meteorologist Travis Meyer flew the damage path and found that a narrow swath of damage continued across the river into southeast Rogers County, where the ground survey team was unable to reach by road. Damage to several homes and extensive tree damage suggested a maximum wind speed of 110 to 120 mph, leading to an EF-2 rating.

Below: This home near Highway 51 and Oneta Rd. was significantly damaged by a May 16 tornado, with most of the roof gone.



Right: This home near E. 71st St. South and Ben Lumpkin Rd. in northern Wagoner County was also considered EF-2 damage.



Below: Although the Radar did not take a direct hit, this building at the site was shifted off its foundation slightly.



Left: An outbuilding destroyed less than a mile north of the Radar site.



After a short break in the damage path, another strong twister developed near U.S. Highway 412 west-northwest of Inola, passing very close to the Doppler Radar site KINX, operated by the NWS Tulsa. The tornado was at its widest and appeared to be strongest in this area, causing the most damage between U.S. 412 and Oklahoma Highway 88 as it moved northeast. Numerous homes suffered significant damage in this area, along with numerous trees, power poles, barns and outbuildings. Damage observed northeast of Oklahoma 88 through its end point southeast of the Claremore Airport was mainly to trees and outbuildings. Based on damage to several homes along with a 50 foot by 60 foot wood-framed shop northwest of Inola, maximum estimated wind in this EF-2 tornado was 110 to 120 mph.

(Continued from page 6)

MID MAY

Poteau River reached moderate flood stage at both Poteau and Panama. Area lakes, which were already mostly full from the rainfall in the weeks prior, filled further, with Sardis and Wister Lakes both going into surcharge. Water began going through the uncontrolled auxiliary spillway at Wister Lake by late on the 20th, and continued to flow on the spillway until the morning of June 8th. Eufaula Lake was still in surcharge, and the rainfall from the 19th caused the lake to rise higher still.

Unfortunately, there was one fatality. On the night of May 21, a 34-year-old man from Hugo, OK, was driving his pickup truck when it became stuck in flood water 4 miles north of Hugo on Ballpark Rd. He walked out and got help, then walked back to the truck to get some personal items. Local media reports he walked about 100 yards when he hit a dip in the road and went under water. He did not resurface. 🌩️

MEMORIAL DAY WEEKEND

Four killed in holiday weekend floods, with widespread flooding damage.

Once again as the Memorial Day Weekend approached, the atmosphere was merely reloading during a brief respite. The rain stayed just south of the Red River on the 21st, only to once again inundate the region beginning on Friday the 22nd. The rain continued right through the Memorial Day weekend, tragically leading to four additional fatalities.

Convection began along and north of the Red River on the 22nd due to persistent upglide north of the surface front in northern Texas. Some areas south of I-40 saw from 1 to 3 inches of rain from the initial round. The front then began to lift north overnight into the morning of the 23rd. A line of severe storms developed over western Oklahoma that afternoon, and by evening, heavy rain was again bearing down on eastern Oklahoma.



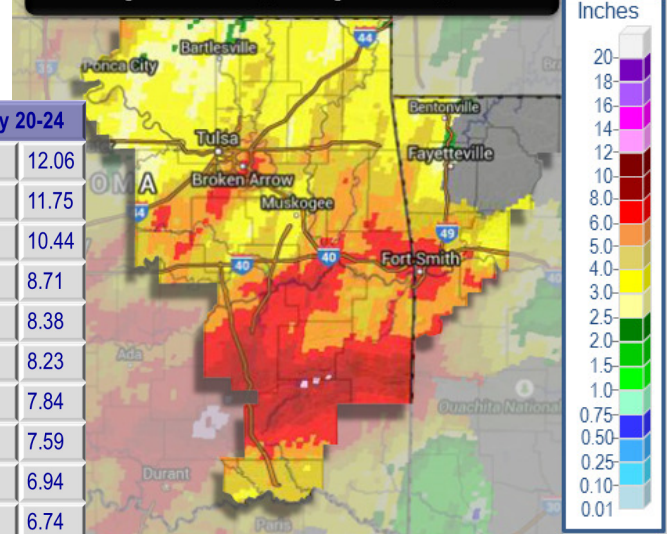
Aerial view of flood waters in Sapulpa, OK, at Park St. and Washington St. on the morning of May 23. Several homes were evacuated in the area.

Photo by Joey Johnson for the Tulsa World

Highest Rain Totals May 20-24

Talihina, OK Mesonet	12.06
Clayton, OK Mesonet	11.75
McAlester, OK Mesonet	10.44
McAlester, OK ASOS	8.71
0.3 WNW Krebs, OK	8.38
Stigler, OK Mesonet	8.23
4.6 ENE Eufaula, OK	7.84
Webbers Falls, OK	7.59
Wister, OK Mesonet	6.94
Fort Smith, AR ASOS	6.74

5-Day Rainfall, May 20-24, 2015



While the storms did produce a brief tornado near Red Oak, OK (Latimer Co.), the bigger impact was the deadly flooding that occurred. Saturated soils, along with ongoing flooding of many of the larger rivers, allowed for rapid rises on smaller streams and quick onset of flash flooding. Rainfall rates up to 2.5 inches per hour were observed in a few areas, but due to the antecedent conditions, flash flooding occurred even with much lower rainfall rates. Widespread 1.5 to 4 inch rainfall totals were noted over most of eastern Oklahoma by 7am on the 24th, with many areas seeing as much as 7 inches.

The rainfall axis shifted further east during the morning and afternoon on the 24th, as convection renewed along the outflow boundary from the overnight storms, impacting western Arkansas and southeast Oklahoma. Widespread rainfall of 1 to 5 inches led to more dangerous flooding in these areas. In just a 2-day period, all of eastern Oklahoma and western Arkansas received from around 2 inches to nearly 8 inches of rain. The 5-day total in parts of southeast Oklahoma was around 12 inches!

Many Flash Flood Warnings were issued, including a Flash Flood Emergency for the Tulsa metro area. The City of Tulsa alone made 55 water-related emergency re-

MEMORIAL DAY

(Continued from page 8)

sponses between 9 and 11pm. A significant number of roads in the Tulsa metro area and suburbs had water over them, some to several feet, and numerous cars stalled in the high water. A number of homes were flooded in Sapulpa, OK (Creek Co.), Catoosa, OK (Rogers Co.), and Beggs, OK (Okmulgee Co.). Many roads, including state and U.S. highways, were flooded from around Okemah, OK (Okfuskee Co.), northeast across the Tulsa area and into the northeast corner of the state. Many roadways were damaged or washed out.



Flood waters washed out this section of Cole Strang Road, 5 miles east of Pryor, OK, on May 25.

Photo by Will Carroll via Facebook

Four fatalities occurred from the heavy rain on the 23rd.

The first fatality was 44-year-old Claremore Fire Captain Jason Farley, who, as a series of water rescues inside

several duplexes were concluding, fell into a rapidly flowing drain pipe on Archer Court at Highway 20 just west of Claremore, OK (Rogers Co.). This tragedy occurred after captain Farley had helped rescue a woman and 6 small children. Also, a 37-year-old man drowned in a drainage ditch in Sapulpa, OK (Creek Co.). He was found on the morning of the 24th. Finally, two 20-year-old men were driving back home to Okmulgee after the Rocklahoma (Pryor, OK, Mayes Co.) concert ended late on the 23rd, but never made it home. They remained missing until June 7th, when their vehicle was found submerged on the Oneta boat ramp on Lake Eufaula (McIntosh Co.). The Medical Examiner determined the cause of death to be accidental drowning.

The heavy rain also led to widespread mainstem river flooding. Of the 33 river forecast points in the NWS Tulsa HSA, 19 rose above flood stage, or if already flooded, rose higher from the additional rain through the 24th. Many of these points reached moderate and major flooding, and several remained above flood stage for a week or more.

If that wasn't enough to put a complete damper on the holiday weekend, a large convective complex developed on Memorial Day (the 25th) in northern Texas and

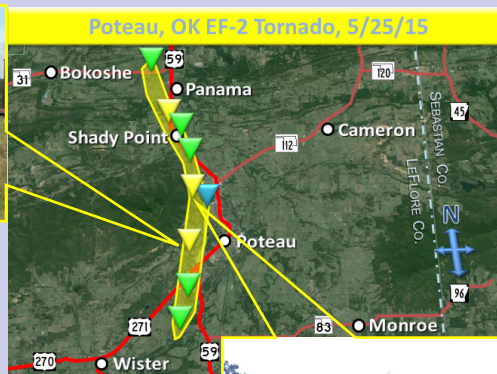
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Poteau, OK Tornado 5/25/15

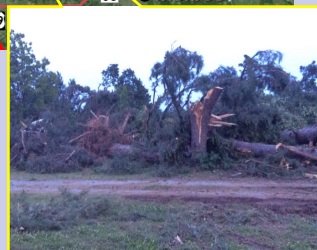
The strong tornado in LeFlore County on May 25 took a rather unusual path. After developing near Kerr Mansion south-southwest of Poteau, the twister initially moved north-northeast, then turned more northward as it tracked just west of the U.S. 59 Bypass near Poteau. It eventually curved to the north-northwest through Shady Point and just west of Panama, dissipating shortly after crossing Oklahoma Highway 31.



Above: This home on Pleasant Valley Rd. west of Poteau lost most of its roof.



Right: EF-2 damage to hardwood trees in the Witteville community NW of Poteau.

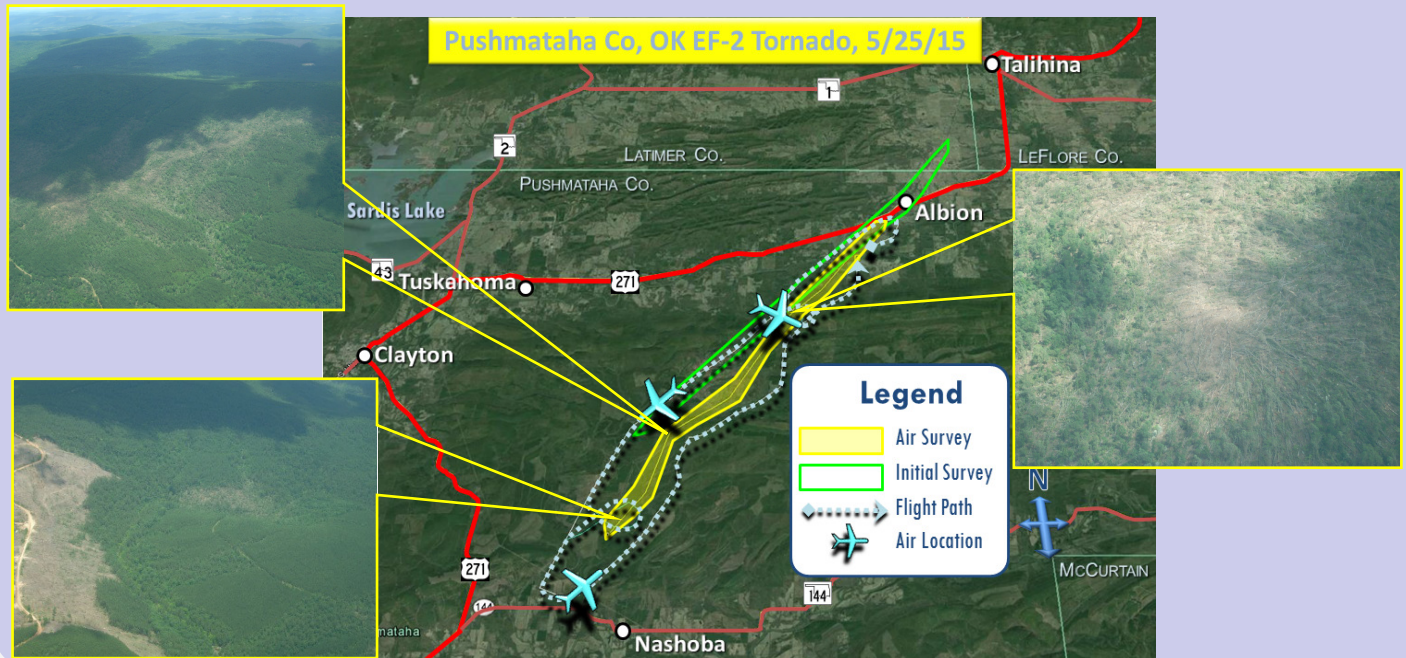


Several homes were severely damaged, while a number of others received roof damage. At least two mobile homes were destroyed, as were several barns and outbuildings. EF-2 damage was noted along Pleasant Valley Rd. west of Poteau, in the community of Witteville northwest of Poteau, and near Shady Point where a cell tower was partially collapsed. Numerous large trees were snapped or uprooted, and power poles were blown down.

Albion, OK Tornado 5/25/15

One of the strong tornadoes on May 25 developed in a heavily wooded area of northern Pushmataha County that is mostly inaccessible by road. The initial beginning point was estimated based on radar data, while the end point was better defined as the tornado crossed U.S. Highway 271 near Albion, where some tree and structural damage was noted. Based on this, it was initially rated as an EF-1 tornado.

The survey team noticed considerable tree damage on the ridges to the southwest of Albion from U.S. 271. With the help of KOKI Fox-23 Meteorologist and licensed pilot James Aydelott, an aerial damage survey was done on June 1. The tree damage was quite impressive on closer inspection, and was also determined to have started at a point a few miles southwest of the original starting point. The rating was changed to EF-2 based on the extent of the tree damage in this hilly, wooded area.



(Continued from page 9)

MEMORIAL DAY

southern Oklahoma, and tracked east along and south of the Red River. As strong wind fields spread downstream of a mid-level wave, the storm complex remained organized and produced severe weather across southeast Oklahoma and west central Arkansas, along with heavy rainfall.

The storms were mostly linear, but rotation developed along some of the linear convective segments, resulting in four tornadoes in southeast Oklahoma, including strong (EF-2) tornadoes in Latimer County and near Poteau (LeFlore Co.). Along and south of I-44, rainfall totals ranged from around 0.25 to around 3 inches. Without time for recovery from the last heavy rain, this additional rainfall resulted in more rapid-onset flash flooding and sustained or higher river flooding. The heavy rain over

the Poteau River basin on the 24th-25th caused major flooding along the river as indicated by the forecast points at Poteau and Panama. Wister Dam was holding back a record amount of water, and the downstream flooding would have been worse had the reservoir not been in place. This rain event led to the 4th and highest crest of the long duration moderate flood along the Kiamichi River near Antlers.

Lake levels continued to rise after all of the rain as well. Wister Lake set a new pool of record late on the 25th, when the pool elevation peaked at 508.35' (previous record was 508.22'). Hugo Lake also reached its new pool of record late on the 25th, with a pool elevation of 440.11' (previous record 440.05'). Inflow into Eufaula Lake reached 250,000 cfs on the 24th, and the lake reached its highest pool level on the 26th. ⚡

ENDING THE MONTH

May 2015 ended on an unsettled and stormy note...to the surprise of absolutely no one!

Several upper-level waves moved over the region during the last week of May, bringing additional rounds of showers and thunderstorms. The first couple of days following the Memorial Day Weekend saw localized bouts of heavy rainfall, which led to some minor flooding.

A convective complex moved east across eastern Oklahoma and into western Arkansas on the morning of the 28th, bringing more widespread rain to all of eastern Oklahoma and the adjacent counties of western Arkansas. This rain once again led to rapid-onset flash flooding. Sand bagging was required in Talihina, OK (LeFlore Co.), to protect some businesses. Numerous roads throughout the region were closed due to high water. Three tornadoes also occurred within the line of storms.

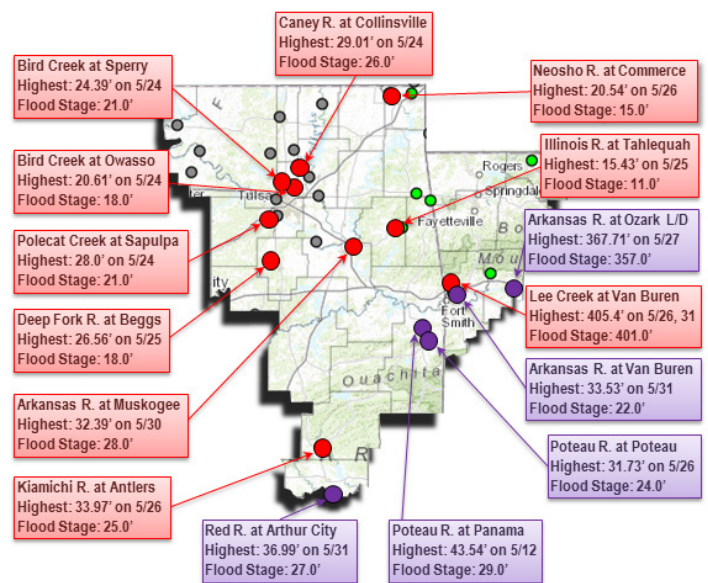
Yet another MCS developed over northern Texas and southern Oklahoma later in the day, tracking east along the Red River into the early morning of the 29th. This brought more heavy rain, with much of McIntosh, Pittsburg, and Latimer Counties in eastern Oklahoma receiving between 2 and 4 inches of rain. Parts of northeast Oklahoma saw up to 2.5 inches of rain, which led to additional moderate flood crests along the Neosho River near Commerce. The Kiamichi River near Antlers had finally fallen below flood stage, but this rainfall caused the river to rise once again to moderate flood levels.

After a few storms lingered through morning of the 29th, widespread showers and thunderstorms, including supercells, moved east through the afternoon and evening, spawning three tornadoes. And, of course, heavy rain fell...again...which led to significant flooding. Extensive street flooding and several water rescues occurred in and around Pryor, OK (Mayes, Co.), and homes were evacuated in Wagoner, OK (Wagoner Co.). Significant street flooding was also reported in the Tulsa and Fort

Smith areas, and in numerous other towns.

The Arkansas River continued to rise with this additional rainfall, resulting in multiple crests of major flooding at Van Buren and Ozark Lock and Dam, and moderate flooding near Muskogee. Lee Creek near Van Buren also experienced two crests of moderate flooding, and the Kiamichi River near Antlers had moderate flooding as well. According to data from the USACE Tulsa District, water likely flowed over the spillway briefly at Sardis Lake from late on the 29th until early on the 31st.

Moderate and Major Flood Points, May 2015



Aside from some light rain in extreme southeast Oklahoma on the 30th, the month actually ended on a dry note in the NWS Tulsa forecast area. However, an MCS brought up to 2 more inches of rain across northern Texas and south central Oklahoma, along the Red River. As this area could basically take no more rain, the water flowed downstream and caused the Red River at Arthur City, which was already experiencing major flooding, to climb even higher. The river crested at 36.99 feet, the second highest crest on record since the upstream Lake Texoma was impounded.

RECORD RAIN: WHAT CAUSED IT?

El Niño conditions were gaining strength in May...could that have contributed?

The current strong El Niño in the Pacific Ocean has actually been developing for some time. NOAA's Climate Prediction Center (CPC) declared that El Niño conditions had developed as early as March of this year. By May, the CPC announced that it had intensified into a "weak to moderate" episode, with additional strengthening noted through the month. This may leave many wondering if this had some impact on what happened during May of this year.

Rainfall Amounts: May 2015

	Tulsa	McAlester	Ft. Smith	Fayetteville
Total	14.77"	22.98"	19.85"	13.01"
Rank	2nd wettest	1st Wettest	1st Wettest	3rd Wettest
May Normal	5.91"	5.17"	5.47"	6.04"
Previous May Record	18.00" (1943)	13.19" (1960)	13.67" (1943)	13.39" (1957)
Record for Any Month	18.81" (Sep 1971)	17.43" (Oct 1981)	15.02" (Jun 1945)	14.96" (Sep 1986)

According to Tom Di Liberto with CPC; "The culprit for these events has been a parade of slow moving storms and a very moist air mass courtesy of the Gulf of Mexico. On a seasonal climate timescale, above-average rains during the spring across the southern tier of the U.S. are a pattern often seen during El Niño events. During El Niños, the jet stream can extend across the southern US, helping to track storms across the south, including the type of storm systems capable of producing the severe thunderstorms that soaked the region. During May, this was exactly what happened, leaving Texas and Oklahoma (and Arkansas) in a prime

location for stormy weather. Of course, El Niño alone cannot account for the record-breaking nature of the rains. We cannot discount the influence of natural variability of our atmosphere (extreme weather sometimes just happens), as well as some influence from climate change, since extreme precipitation events are likely to increase and have increased as the planet warms and the atmosphere gets wetter."

If we look at some specifics of the weather pattern in May, the subtropical jet was, on average, abnormally strong across northern Mexico, with downstream troughing, resulting in abnormally strong southerly flow across the Southern Plains (Figure 1). Further, there was a broad region of abnormally strong upward motion for May across the Southern Plains and south Texas, along with anomalously high moisture (Figure 2).

The pattern was also marked by abnormally low upper-level pressure over southern California and the adjacent Pacific Ocean, which favored a storm track over the moisture rich Baja Peninsula, northeast into the Southern Plains (Figure 3). At the same time, anomalous high pressure over the eastern U.S. promotes moisture rich flow from the Gulf of Mexico into the southern Plains. Finally, the significantly anomalous high pressure over the Gulf of Alaska and anomalous low pressure over southern California, when combined, indicate a blocking pattern over the west coast/eastern Pacific Ocean, resulting in the persistent stormy weather and ultimately, record rainfall. ⚡

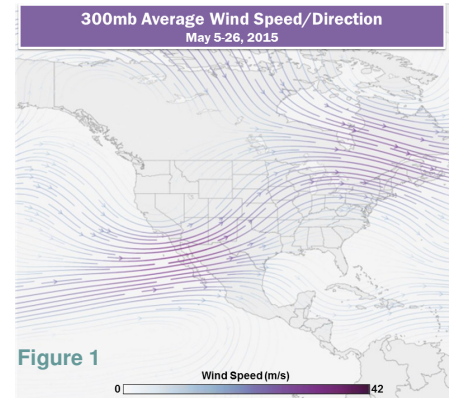


Figure 1
For most of May, the jet stream persistently steered storms full of moisture into the Southern Plains states of Texas and Oklahoma.

NOAA Climate.gov map by Hunter Allen, based on NCEP/NCAR Reanalysis data provided by NOAA ESRL.

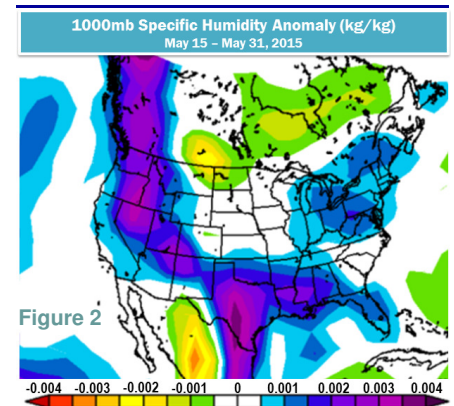


Figure 2
Low-level moisture was abnormally high for the last two weeks of May along the corridor of heaviest flooding. The precipitable water anomalies for the month surprisingly did not show a strong signal.

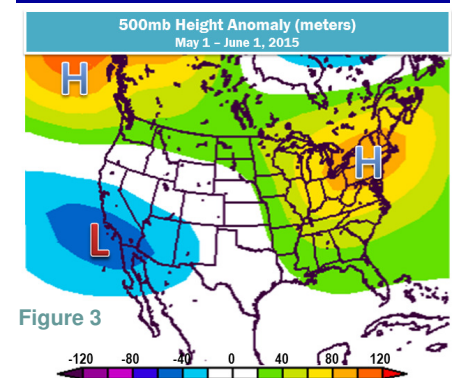


Figure 3
The combination of abnormally low pressure in the mid levels off the California coast, coupled with higher than normal mid level pressures over the eastern U.S. and the Gulf of Alaska, led to a very persistent stormy pattern for the month of May.

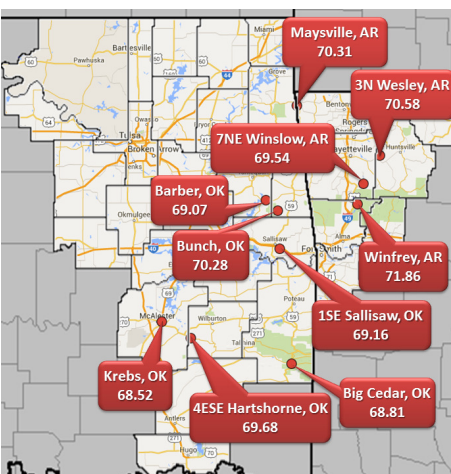
DROUGHT UPDATE

Mother Nature giveth...Mother Nature taketh away...and giveth again!

Southeast Oklahoma undoubtedly needed some time to dry out after the May rains. It got that and more as spring turned to summer.

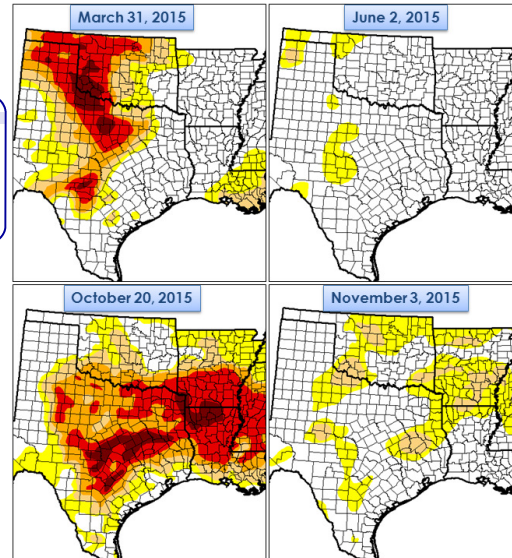
An early brush with tropical weather mostly by-passed far southeast Oklahoma as the remnants of Tropical Storm "Bill" moved north through Texas on June 17-18 and brought excessive rainfall amounts of 8-12 inches to south central Oklahoma. Most areas east of Highway 75 and south of I-40 saw 2 to 3 inches from this system, but finished June with below normal rainfall.

The trend of below normal rainfall across far southeast Oklahoma into west central Arkansas continued throughout July and August. In fact, during the period from July 10 through September 3, Choctaw and southern Pushmataha counties in southeast Oklahoma received less than 20 percent of the normal rainfall for that time period. The strong summer sun allowed much of the rain from the spring and early summer to evaporate during July and August (and brought some extremely high heat index values). The lack of rainfall combined with the evaporation quickly depleted the soil moisture across southeast Oklahoma, resulting in the development of "flash drought" conditions in some of the same areas that were inundated with record rainfall in May!

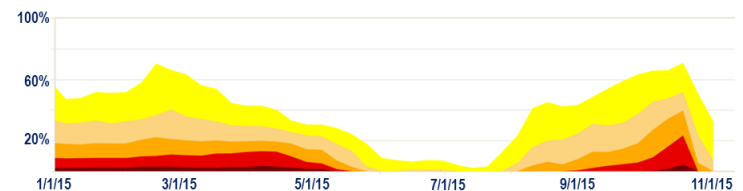
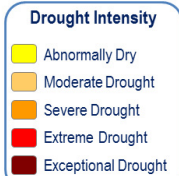


Maximum Water Year (10/1/14 - 10/31/15) Rainfall Amounts.

The early fall months of September and October largely followed suit with both months seeing significantly below



Heavy spring rains eliminated drought in much of the south central U.S. Dry weather in late summer and early fall brought them back, only to be largely wiped out by heavy rains in late October.



The graph above shows the percentage of the South Central region (OK, TX, AR, LA, MS, TN) that have been included in the various drought categories, dating back to January 1, 2015. After being all but wiped off the map by June, "flash" drought resulted in a higher percentage of the region in extreme drought compared to the beginning of the spring.

normal rainfall. Statistically, the period of July 4 through September 30 was actually the 11th driest such period on record for the southeast Oklahoma climate division, though, in the longer term, it remained the 9th wettest calendar year through October 1.

As the dry weather persisted, extreme drought conditions had actually begun to creep into portions of Choctaw County by the last half of the month, for the first time since September 2013! But, in a flashback to this past spring, a deep low pressure system tapped into tropical moisture at the end of October. This brought devastating floods to central Texas, and enough rainfall to significantly ease the flash drought across southeast Oklahoma.

As the calendar turned to November, more significant rains fell across the region. As of the November 3, all of the extreme and exceptional drought areas in the south central region were gone, with only a portion of Pushmataha County remaining in a Moderate Drought. ⚡